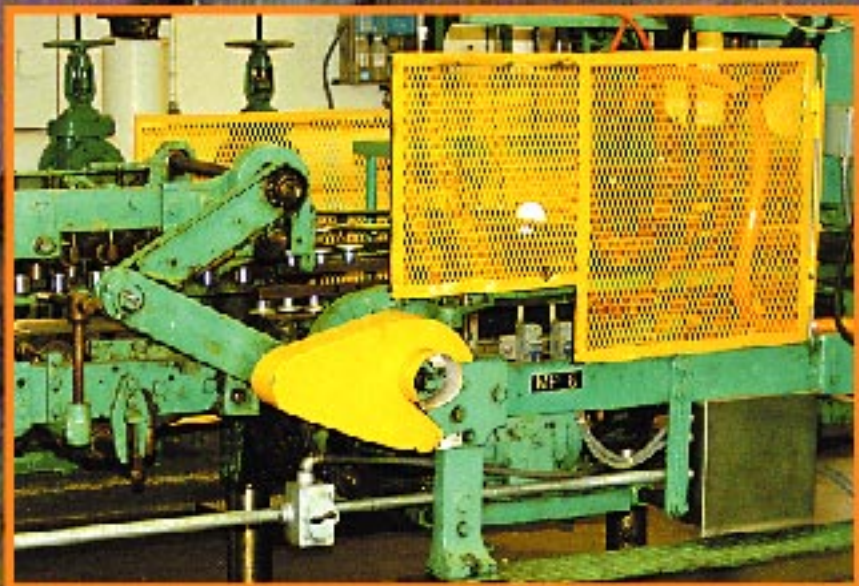


Guarding Mechanical Power Transmission Parts



A guide to the requirements in
Chapter 296-24, Section 205 in the
General Safety and Health Standards



Department of
LABOR AND
INDUSTRIES



Introduction

This booklet is the first of a series that the Washington Department of Labor and Industries will publish to help employers understand and comply with specific occupational safety and health requirements. It is designed to help those small to medium size companies that can benefit from guidance in how to comply with WAC 296-24-205, Guarding Power Transmission Parts. Those employers who follow and maintain the suggestions in this booklet will be considered as meeting the requirements of this WAC. This WAC was rewritten for clarity. The new format should make this standard easier to read and understand. There are no new requirements.

Several sections list requirements that must be met. These lists may be bulleted, numbered, or lettered. When items in a list are separated by “or,” it means that the minimum requirement may be met by doing just one of the listed items. When items in a list are separated by “and,” it means that all items must be followed to meet the minimum requirements.

This booklet concentrates on the power transmission parts of machines and machinery, not on their “point of operation” hazards. Point of operation will be addressed in a future booklet. Also, this booklet does not cover power transmission requirements in WISHA standards other than WAC 296-24. Specific industries may have additional requirements.

Hazards involving moving power transmission parts are found in most workplaces. All have the potential to cause serious harm to workers and must be controlled. This guide will describe the primary ways that these hazards can be controlled. Employers can use other effective means and methods that have been developed for and adapted to their workplaces.

Disclaimer: This book is not meant to make enforceable those suggestions that exceed legal requirements. Any use of trade, product or business names is for descriptive purposes only and does not imply endorsement by the Department of Labor and Industries.

Additional Resources

WISHA

Web Site

WISHA's web site is www.lni.wa.gov/wisha. It has regulations, policies, news, resources and an e-mail feature. Send in questions and get a reply.

Safety and Health Video Library

Call 1-800-574-9881 for information on getting safety and health videos.

Consultation Services

WISHA's regional offices offer safety consultation services for employers. Call the office nearest your workplace for more information.

Everett - (425) 290-1431

Seattle - (206) 515-5880

Tacoma - (253) 596-3917

Tumwater - (360) 902-5472

East Wenatchee - (509) 886-6570

Spokane - (509) 324-2543

Other Resources

- ◆ ASME Safety Standard for Power Transmission, ASME B15.1 (1996)
- ◆ OSHA Manual 3067, Concepts and Techniques of Machine Safeguarding
- ◆ Equipment and industry magazines and catalogs

Power Transmission - Parts

Part 1

Power Transmission - Parts

Definitions of Power Transmission Parts (PTPs)

Power transmission parts (PTPs) are the mechanical components of a piece of equipment that, together with a source of power (sometimes referred to as a “prime mover”), provide the motion to a part of that machine or equipment. The power from the prime mover is transferred through the use of gears, flywheels, cranks, shafts, chains, sprockets, belts, pulleys, pistons, couplings, connecting rods, etc., to the various machines found in the workplace. The power from the prime mover can come from mechanical, pneumatic, hydraulic, steam, or electrical sources.

Gears

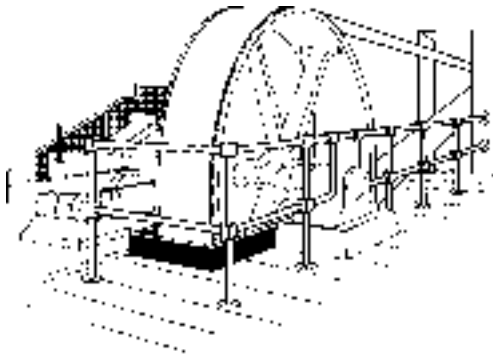
Two or more wheels with teeth around their outside edges that mesh together, transferring energy from one wheel to the other. Gears include gear drives and worm drives.



Power Transmission - Parts

Flywheels

A large wheel used to store kinetic energy to be translated into mechanical energy through the use of a cam, crankshaft or other means. Flywheels include flywheels, balance wheels, and flywheel pulleys mounted on an engine or revolving on a crankshaft or other type of shaft.



FLYWHEEL WITH HORIZONTAL BELT

Cranks

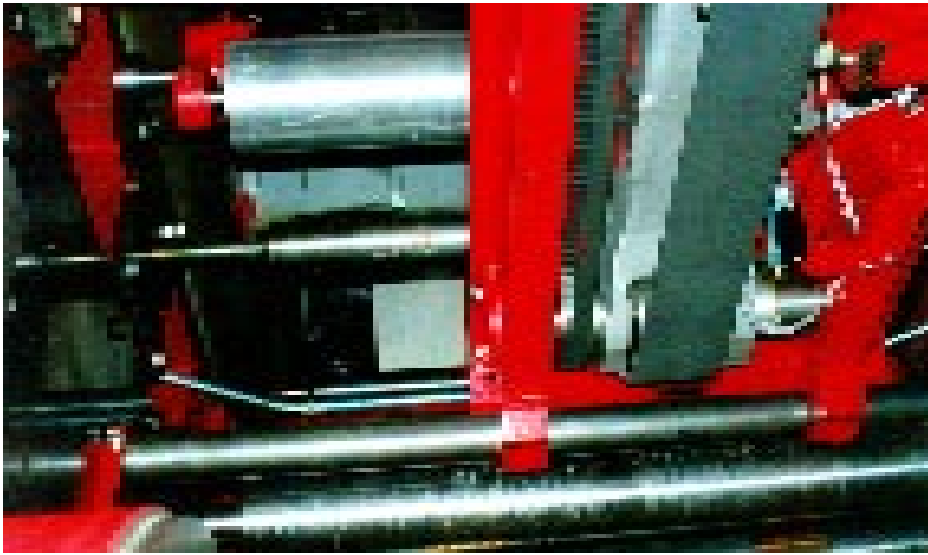
A crank is a device for transmitting rotary power. It has an arm attached to a shaft at right angles.



Power Transmission - Parts

Belts

Belts include all power transmission belts, such as flat belts, round belts, V-belts, etc., unless otherwise specified.



Overhead belts and pulleys



Inclined belts and pulleys

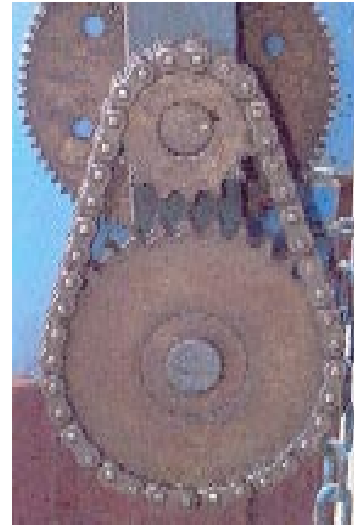


Belt and shifter

Power Transmission - Parts

Chain Drives

A metal chain that runs between a drive sprocket and another sprocket to power a machine.



Two different types of chain drives

Shafts

Shafts are direct drives, used to transfer energy from the prime mover directly to the equipment being operated.



Partially guarded shaft



Partially guarded shaft end

Power Transmission - Parts

Do I have power transmission equipment?

To help you determine if your workplace requires safeguarding of power transmission parts, use the following decision logic steps (It is possible to get a “no” answer in some cases).

1. Does my workplace contain any motors?
Yes ☐ go to question No. 6
No ☐ go to question No. 2
2. Does my workplace contain any compressors?
Yes ☐ go to question No. 6
No ☐ go to question No. 3
3. Does my workplace contain any stationary engines?
Yes ☐ go to question No. 6
No ☐ go to question No. 4
4. Does my workplace contain any pumps?
Yes ☐ go to question No. 6
No ☐ go to question No. 5
5. Does my workplace contain any prime mover or other means as a source of power?
Yes ☐ go to question No. 6
No ☐ go directly to statement No. 26
6. Is the prime mover connected to a shaft, crank, pulley, gear, piston, sprocket or other power transmission part?
Yes ☐ go to question No. 7
No ☐ go directly to statement No. 26
7. Are the power transmission parts more than 7 feet above the walking or working surfaces where employees could go?
Yes ☐ go to question No. 8
No ☐ go to question No. 12
8. Is the power transmission part more than 7 feet above the walking or working surfaces and overhead belt that has a speed of 1,800 feet per minute or greater?
Yes ☐ go to statement No. 25
No ☐ go to question No. 9

Power Transmission - Parts

9. Is the power transmission part that is more than 7 feet above the walking or working surface an over-head belt with a distance between centers of its pulleys of ten feet or more?
- Yes ☐ go to statement No. 25
No ☐ go to question No. 10
10. Is the power transmission part that is more than 7 feet above the walking or working surface an over-head belt that is wider than eight inches?
- Yes ☐ go to statement 25
No ☐ go to question No. 11
11. Are the power transmission parts that are more than 7 feet above the walking or working surface so supported or secured that they cannot fall onto a person below?
- Yes ☐ go directly to statement No. 26
No ☐ go to question No. 12
12. The power transmission parts include a belt drive with a speed at 250 feet per minute or less?
- Yes ☐ go to question No. 13
No ☐ go to question No. 17
13. Is the power transmission belt being driven flat and one inch wide or less?
- Yes ☐ go directly to statement No. 26
No ☐ go to question No. 14
14. Is the power transmission belt being driven flat with a width of one to two inches with no metal lacings or fasteners?
- Yes ☐ go directly to statement No. 26
No ☐ go to question No. 15
15. Is the power transmission belt round with a one-half inch diameter or less?
- Yes ☐ go directly to statement No. 26
No ☐ go to question No. 16
16. Is the power transmission belt a single V-belt drive with a belt width of 13/32 inches or less?
- Yes ☐ go directly to statement No. 26
No ☐ go to question No. 17
17. The power transmission parts include a chain drive?
- Yes ☐ go directly to statement No. 26
No ☐ go to question No. 18

Power Transmission - Parts

18. The power transmission parts include a rope drive with a speed at 250 feet per minute or less?
Yes ☐ go directly to statement No. 26
No ☐ go to question No. 19
19. The power transmission parts include hand-operated gears used to adjust machine parts that only turn when moved by hand (manual turning) and at no other time?
Yes ☐ go directly to statement No. 26
No ☐ go to question No. 20
20. Are the power transmission parts found only on medium to light duty sewing machines that are not used to sew heavy materials like leather, canvas, denim or vinyl?
Yes ☐ go to question No. 21
No ☐ go directly to statement No. 25
21. Is the sewing machine belt flat or round without metal lacings or fasteners?
Yes ☐ go to question No. 22
No ☐ go directly to statement No. 25
22. Is the sewing machine belt located above the tabletop?
Yes ☐ go to question No. 23
No ☐ go directly to statement No. 25
23. Is the sewing machine belt located so that when the machine is being operated and material is being fed to the needle using both hands the operator is not exposed to this motion hazard?
Yes ☐ go to question No. 24
No ☐ go directly to statement No. 25
24. Is the sewing machine table top designed so that other employees near the machine are not exposed to the belt and wheel motion hazards while they pass by or work at their location?
Yes ☐ go directly to statement No. 26
No ☐ go directly to statement No. 25
25. The power transmission part you describe **IS** covered by WAC 296-24-205.
26. The power transmission part you describe **IS NOT** covered by WAC 296-24-205.

Power Transmission - Parts

Other mechanical power transmission standards

If your business is also covered by other standards, such as Agriculture or Sawmills, you may be required to follow additional power transmission parts guarding requirement. Here is a list of other standards with mechanical power transmission parts guarding requirements.

WAC 296-32, Telecommunications (section 220(5)(a))

WAC 296-54, Logging (section 551(15)(a))

WAC 296-59, Ski Lifts (section 130)

WAC 296-78, Sawmills (sections 71505, 70509(3) and (4))

WAC 296-79, Pulp and Paper (section 030(1))

WAC 296-155, Construction (sections 350(b), 487(6) and 488(h))

WAC 296-301, Textiles (section 020(3))

WAC 296-302, Bakery Equipment (sections 020 and 025)

WAC 296-303, Laundry Machines (sections 01003, 030(1) and 040(1))

WAC 296-307, Agriculture (section 280)

Part 2

Power Transmission - Hazards

What are the hazards?

The hazards of PTPs include, but are not limited to:

- ◆ Grabbers
- ◆ Nip Points
- ◆ Cutters
- ◆ Flying and falling objects
- ◆ Reciprocating motions
- ◆ Transverse motions
- ◆ Combination hazards

Grabbers

Grabbers are components of the PTPs that can catch or grab loose clothing, long hair, or any part of the body they come in contact with.

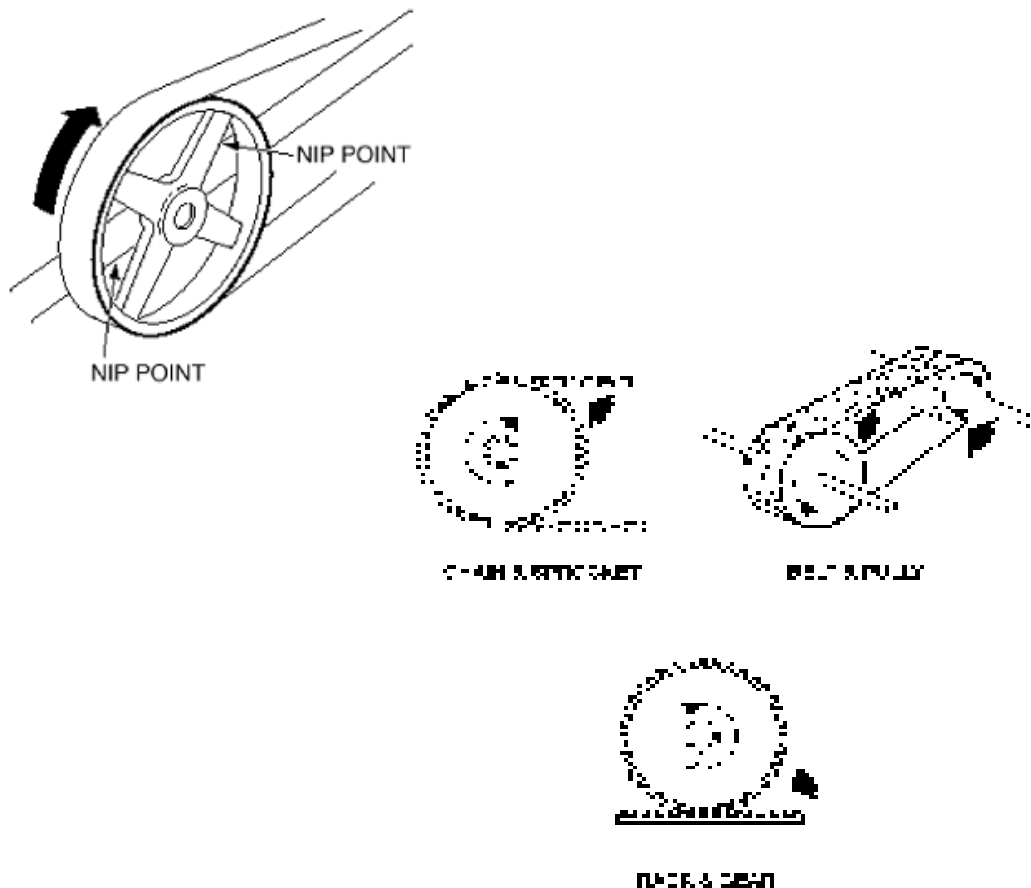
An unguarded shaft like this can grab loose clothing, long hair, or any part of the body that touches it. This can pull a worker into the machinery.



Power Transmission - Hazards

Nip Points

Another type of grabber is a nip or pinch point. This happens when two parts rotate or come together. One part may rotate and the other part may be stationary, such as a pulley and its guard. A worker can get caught between two of these points and be pulled in. This can cause serious injury or even death. Some examples of this are rollers, gears, belts, and chain drives.

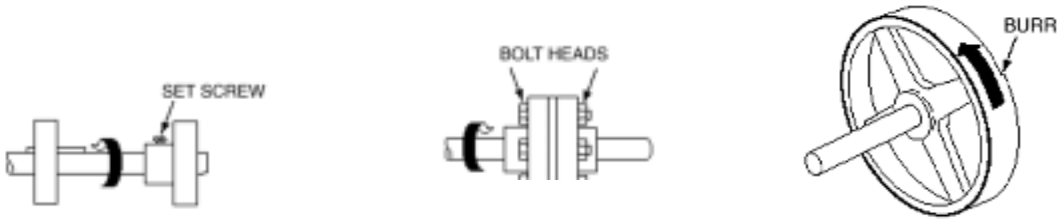


These four drawings are examples of nip points.

Power Transmission - Hazards

Cutters

Power transmission surfaces may have sharp edges and/or have projections from the surfaces. These present potentially serious hazards to workers who contact them, and can cause injuries such as puncture or laceration wounds.



Workers may have to remove guards from time to time to service the parts inside the guard. These guard surfaces need to be smooth to minimize worker exposure to hazardous surfaces, even when workers are expected to be wearing hand protection.

Hazards

This mesh guard has sharp, rough edges that can easily cut a worker.

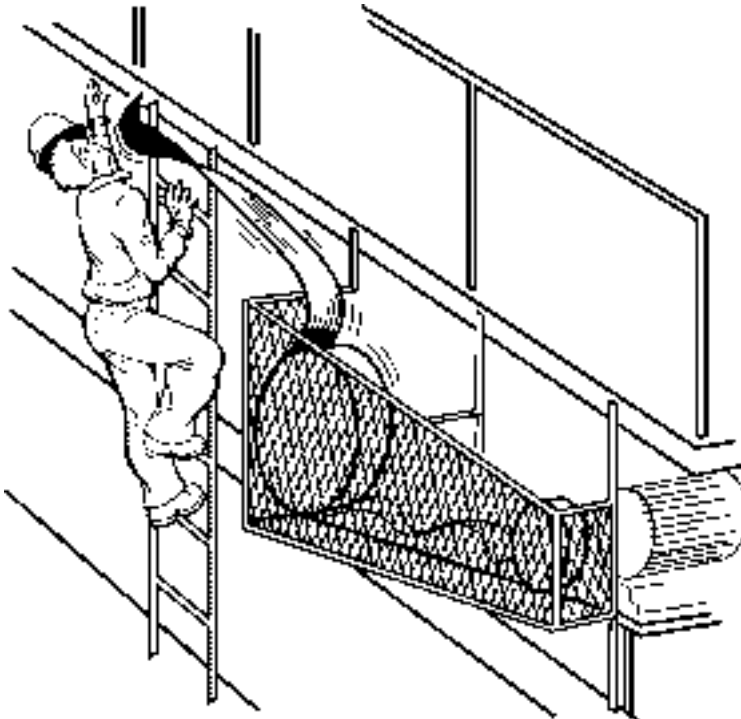


Power Transmission - Hazards

Flying and Falling Objects

Flying and falling objects that come off PTPs can cause severe bodily harm or death if they strike a worker. Make sure that:

- ◆ Setscrews, bolts, nuts and similar fasteners are torqued properly. If they are loose, they can fly off the PTP or the PTP may come apart.
- ◆ Parts are properly lubricated. Friction causes part failure. Do not over-lubricate either. Even a flying glob of grease can hit a worker hard enough to cause injury.
- ◆ Belts and chains have the proper tension. Loose belts and chains can break and fly off. If they are too tight they can cause premature wear and failure of the PTP.
- ◆ PTPs are operated at the speeds recommended by the manufacturer. Excessive speed can cause PTPs to come apart and become deadly flying objects.
- ◆ Hangars, support brackets, and other ways of mounting overhead PTPs are securely fastened.



Power Transmission - Hazards

More than one kind of flying or falling hazard can exist at the same time. The picture below shows a belt that came off its pulley. A hammer and loose shavings are near it.

All of these can become flying objects that can injure a worker.



Hazards

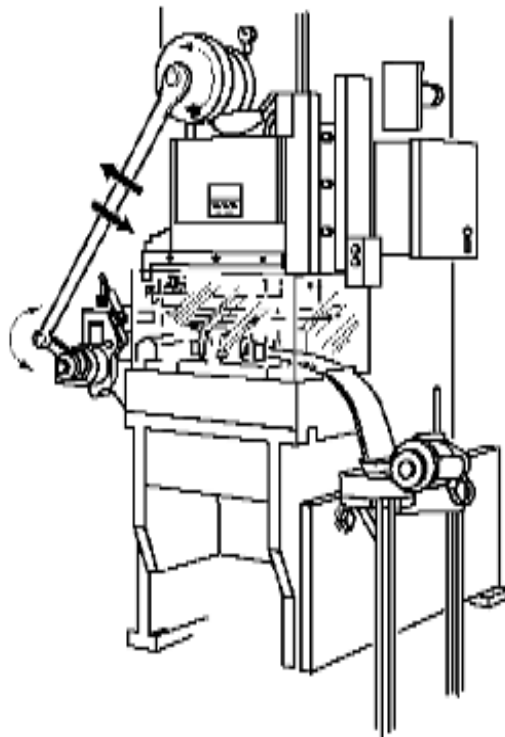
Power Transmission - Hazards

Reciprocating motion

A *reciprocating* power transmission part (PTP) moves back and forth or up and down. The hazard to workers is being struck or caught by a part and then jerked back and forth. This motion can be at a steady pace, or on a periodic motion which stops and starts based on the needs of the machine it serves.

One example is hydraulic pistons and connecting rods under a flight simulator . This same type of power transmission is finding its way into a variety of uses from amusement rides to machine applications.

Cranks and connecting rods are classic examples of reciprocating motion in power transmission parts. The worker can be struck or caught and shaken with sufficient force to cause serious injury.

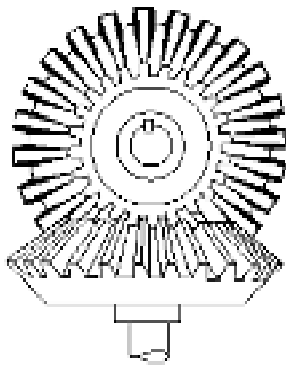


Power Transmission - Hazards

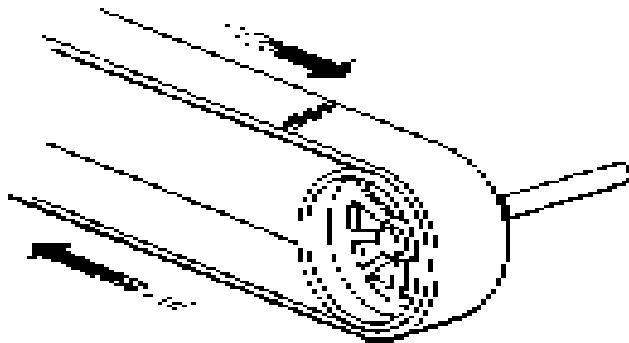
Transverse motion hazards

The last common motion hazard of power transmission parts is that of transverse motion. This motion is usually a movement that is in a straight continuous line and the power is transmitted from one part to the other at a right (or 90 degree) angle. The hazard to employees is being caught in the nip or pinch point or being struck by the part. Examples of this motion would be:

- ♦ A set of bevel gears to drive a shaft that is at 90 degrees from the other.



- ♦ A pulley to drive a long belt that is at a 90 degree angle from the pulley shaft.

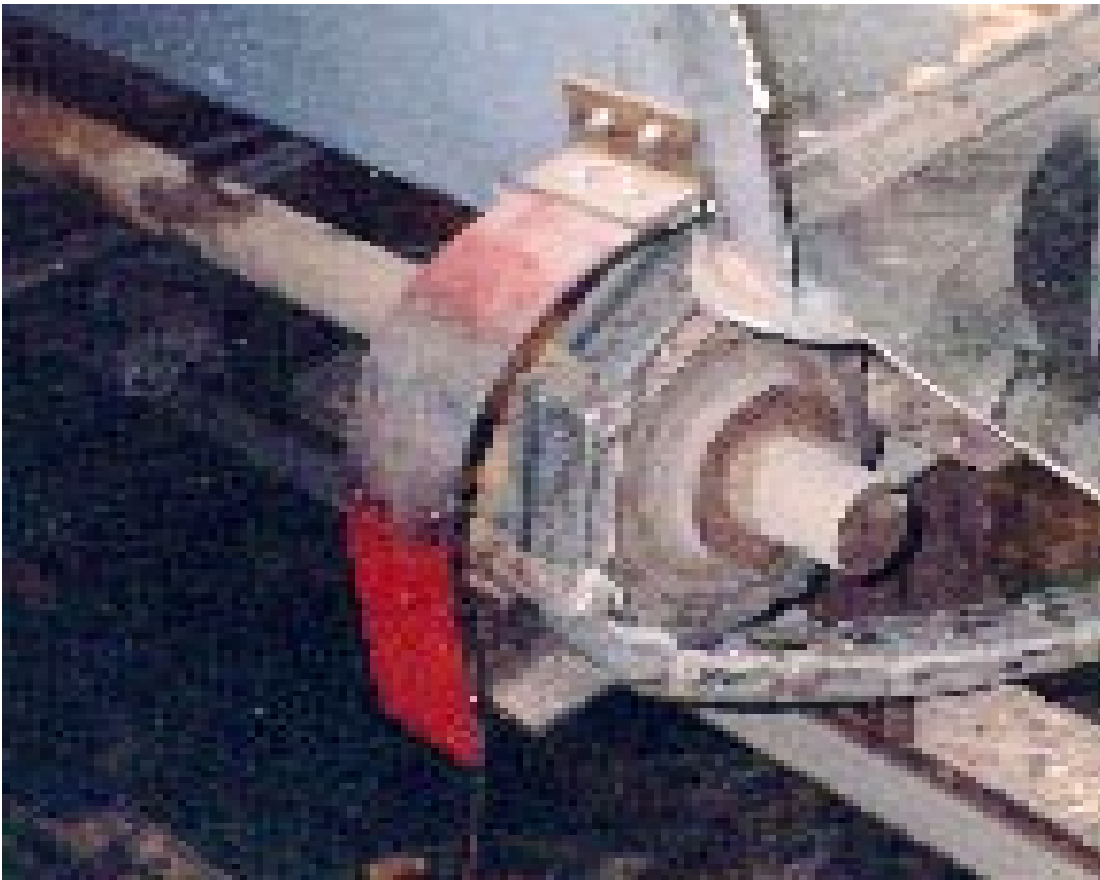


Power Transmission - Hazards

Combination Hazards

PTPs can have more than one hazard at a time. They can have any combination of grabbing, throwing/falling, and cutting. The picture below has several hazards.

The shafting, shaft end, and chain drive are not guarded properly. A worker could easily be cut by any part of these PTPs, or grabbed and pulled into them. The result could be serious injury or death.



These PTPs should be completely enclosed with a guard and/or barrier to prevent worker contact.

Part 3

Guarding Power Transmission Parts

Overview

WAC 296-24-205 provides employers with four different approaches to guard power transmission parts. These four approaches are:

- ◆ Using guards or barriers
- ◆ Guarding by device
- ◆ Guarding by distance
- ◆ Guarding by location

Employers may use various combinations of these methods to provide a safe workplace. The employer may use several different guarding approaches throughout the worksite as long as it prevents employee exposure. Each of these acceptable safeguarding methods are described in this chapter.

Power Transmission Parts - Guarding

Using Guards or Barriers

The most common method for safeguarding PTPs is the use of fixed guards or barriers. These guards may be made by the machine manufacturer or the employer to fit a specific location. Whichever type of guard is used, it must meet the following five criteria.

1. The guard must be designed so that workers cannot reach the moving parts. If the material used to make the guard has openings, such as perforated or expanded metal or heavy duty screening, then the size of the openings should be small enough or the distance of the guard from the PTP should be great enough that the workers fingers could not reach the moving parts.



This size mesh will keep fingers out of the PTP.

Power Transmission Parts - Guarding

2. The guard must be made of materials that will be able to prevent PTPs from flying out if they become loose or break. Any part thrown from the PTPs must be retained within the fixed guard.

Guards installed on PTPs in overhead areas above working or walking areas need to be strong enough to prevent any broken or loose parts from falling on workers.



This overhead PTP is completely enclosed by a guard that is strong enough to contain any parts that could break and fly or fall off.

Power Transmission Parts - Guarding

3. The design and materials used in the guard must make it durable under the conditions where it will be used and the forces it will encounter. This does not mean that all guards will have to be made from metal castings or metal fabricated parts. Wood materials can be used in the fabrication of any guard **if** the wood materials and the design will be durable under the conditions of use.



This guard is made of wood. It has a smooth finish so it won't cut workers.

Power Transmission Parts - Guarding

4. The guard must be securely fastened every 3 feet. The guard must be firmly secured in place and not easily dislodged. The guards may be permanently welded. However, bolts and screws are acceptable if the guard needs to be removed often. *No matter how it is fastened, the guard must be capable of containing the anticipated forces.*



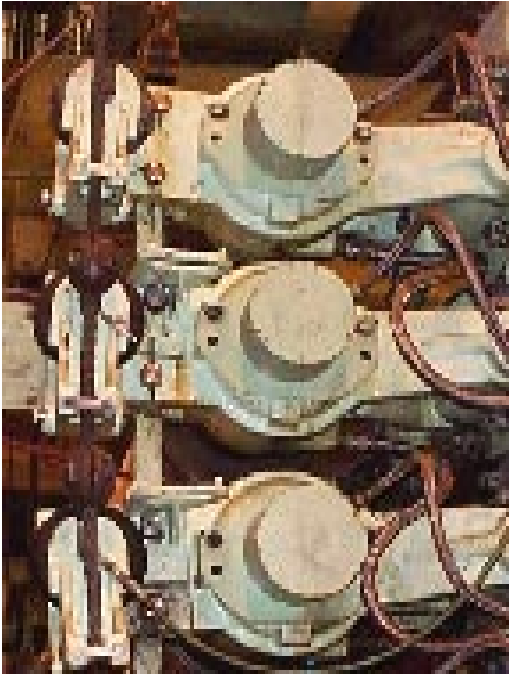
Guarding

This guard has a built-in inspection and maintenance port.

When lubrication and maintenance cannot be done without removing the guard, a lockout/tagout procedure must be followed. See WAC 296-24-110 (Control of Hazardous Energy) for more information on lockout/tagout.

Power Transmission Parts - Guarding

Here are more examples of acceptable guards:



These shaft ends are completely enclosed with a “cup” type guard.

This is a completely enclosed shaft coupling guard (the red shaft guard should be enclosed on the bottom).



Power Transmission Parts - Guarding

More good guards



Metal mesh guard on an inclined belt and pulley

This guard also opens on hinges for inspection and maintenance of the PTP inside



Guarding

Power Transmission Parts - Guarding

Guarding by Device

Devices are more limited than fixed guards. Acceptable devices must meet specific criteria in order for them to be effective in safeguarding PTPs.

- ◆ The device must be able to stop the motion of the PTPs before a worker can come into contact with the PTP.
- ◆ The device must be capable of preventing the PTP from being restarted unless a worker manually resets it.

Devices by themselves are not generally sufficient. Parts from PTPs can still fly or fall off and strike workers. Guards to contain these objects must also be used if such hazards are present.



Pressure-sensitive pads stop machinery when they are stepped on

NOTE: Some “emergency stop” controls require human action and/or warning signals alone to work. These are NOT acceptable devices for guarding PTPs. Human action and reaction are just too slow.

Power Transmission Parts - Guarding

Guarding by Distance

Distance may be used to safeguard PTPs if:

- ◆ The PTP is far enough away that no contact with a worker can occur, **and** the hazards of flying and falling objects are controlled.
- ◆ The horizontal distance between PTPs and fixed ladders, stairs or any other walking/working surfaces prevent any part of the worker's body from reaching the PTP.
- ◆ The PTPs are high enough and away from any employee. For example, tall workers may stretch while standing under the PTP. The PTP needs to be out of their reach.

Power Transmission Parts - Guarding

Guarding by Location

The typical application for safeguarding by location would be the use of a locked room where PTPs are located. The key guidelines for this are:

The room must be locked and accessible only to authorized personnel.

The entrance must be equipped with signs warning of the dangers within.

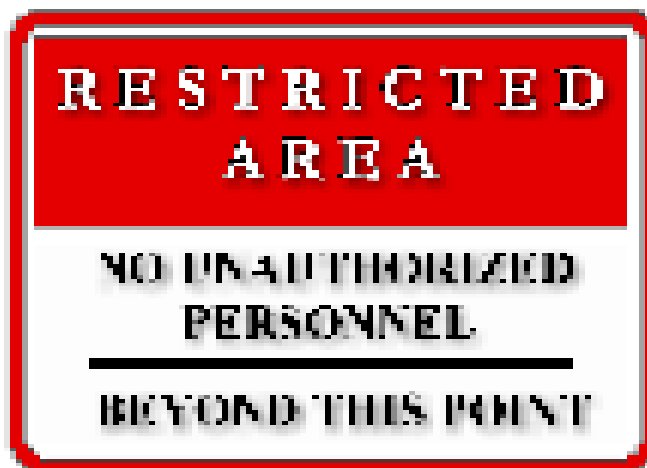
The vertical clearance or ceiling height must be at least 5 1/2 feet.

The room must be well lit, and kept dry to prevent slippery floors.

The floor must be solid and firm so that it does not bounce when walked on.

The passageways within the room must be well marked and easy to follow.

Another example of safeguarding by location is a mezzanine area. A mezzanine area is a raised platform or balcony that is accessible only by a fixed ladder or stair. The guidelines for a mezzanine area are the same as a locked room except the lock is a chain or gate across the stairs or ladder.



Power Transmission Parts - Guarding

Using Guardrails

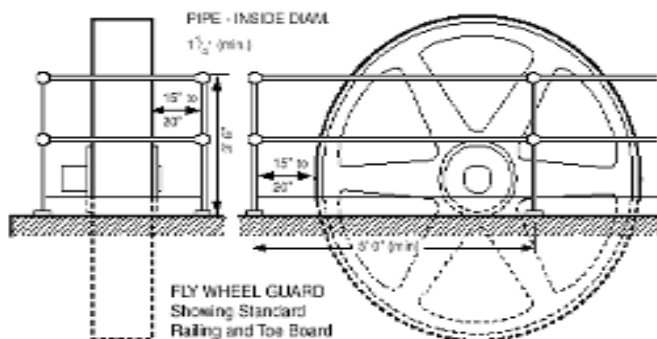
Guardrails are not generally accepted as the sole means to guard a PTP. They can be used as part of an overall guarding system that also controls both worker access to the PTP and falling and flying objects.

Some general criteria for a guardrail system are:

- ◆ They must be made up of a top rail, intermediate rail and posts.
- ◆ The top rail must have a vertical height between 36 and 42 inches and a smooth surface throughout its length.
- ◆ The intermediate rail must be about halfway between the top rail and the walking surface.
- ◆ The ends of the rails are not to overhang in a manner that would constitute a projection hazard.

Guardrails are not generally accepted as a safeguard for PTPs. However guardrails may be used in certain instances when additional criteria are met. The criteria are:

- ◆ The guardrail must have a toeboard that is at least four inches high.
- ◆ The space between the toeboard and the walking surface may not be greater than $\frac{1}{4}$ inch.



This is an example of guardrail use. The required flywheel enclosure has been removed for illustrative purposes.

Power Transmission - Appendix A

WAC 296-24-205 Safeguarding power transmission parts. [Statutory Authority: Chapter 49.17.010, .040, .050 RCW. 98-10-073 (Order 97-11), § 296-24-205, filed 05/04/98, effective 1/1/99. Order 73-5 § 296-24-205, filed 5/9/73 and Order 73-4, § 296-24-205, filed 5/7/73.]

WAC 296-24-20501 What is an employer's duty to protect employees from hazards of power transmission parts? An employer must protect employees from the hazards of power transmission created by moving objects and parts, including flying objects, falling objects and inherently hazardous surfaces, such as sharp edges, burrs, and protruding nails and bolts.

Specifically, an employer must use enclosure guards, devices, a safe distance, or a safe location to protect employees from the following:

- (1) Belt and rope drives, including pulleys;
- (2) Chain drives;
- (3) Shafts, crankshafts, shaft ends, couplings;
- (4) Gears;
- (5) Flywheels;
- (6) Cams and piston rods;
- (7) Other machine parts that transmit power and expose workers to hazards.

“Power transmission parts” means the mechanical components of a piece of equipment that, together with a source of power (sometimes referred to as a prime mover), provide the motion to a part of a machine or piece of equipment.

Note: Guardrails are not generally accepted as a safeguarding method, but see WAC 296-24-20513 for exceptions when guardrails may be used.

Note: See WAC 296-24-20521(1) for a list of power transmission belts that are exempt from the requirements of this section. [Statutory Authority: RCW 49.17.010, .040, .050. 99-19-112 (Order 99-23), § 296-24-20501, filed 09/21/99, effective 01/01/2000. Statutory Authority: Chapter 49.17.010, .040, .050, RCW. 98-10-073 (Order 97-11), § 296-24-20501, filed 5/4/98, effective 1/1/99. Chapter 49.17 RCW. 89-11-035 (Order 89-03), § 296-24-20501, filed 5/15/89, effective 6/30/89; Order 73-5, § 296-24-20501, filed 5/9/73 and Order 73-4, § 296-24-20501, filed 5/7/73.]

WAC 296-24-20503 What requirements must guards meet? If relying upon a guard, the employer must ensure that it does the following:

- Prevents any part of an employee's body from reaching the hazard by reaching over, under, through, or past the guard;
- Prevents objects from flying toward, or falling onto, an employee;
- Is made of durable material designed to withstand the forces to which it could be exposed;
- Is securely fastened at least every three feet to a fixed part of the machine it safeguards or the building structure; and
- Creates no additional hazards such as from sharp edges or from motion between it and moving parts.

[Statutory Authority: RCW 49.17.010, .040, .050. 99-19-112 (Order 99-23), § 296-24-20503, filed 09/21/99, effective 01/01/2000. Statutory Authority: Chapter 49.17.010, .040, .050, RCW. 98-10-073 (Order 97-11), § 296-24-20503, filed 5/4/98, effective 1/1/99. Chapter 49.17 RCW. 90-03-029 (Order 89-20), § 296-24-20503, filed 1/11/90, effective 2/26/90; 89-11-035 (Order 89-03), § 296-24-20503, filed 5/15/89, effective 6/30/89; Order 73-5, § 296-24-20503, filed 5/9/73 and Order 73-4, § 296-24-20503, filed 5/7/73.]

Power Transmission - Appendix A

WAC 296-24-20505 What requirements must devices meet? To safeguard using a device, an employer must ensure that it:

- Stops motion of the power transmission parts before an employee is exposed to the hazard of coming into contact with a moving part; and
- Prevents the machine from restarting unless an employee manually resets it.

Note: Emergency stop controls or warning signals are not considered devices that, by themselves, effectively safeguard power transmission parts. [Statutory Authority: RCW 49.17.010, .040, .050. 99-19-112 (Order 99-23), § 296-24-20505, filed 09/21/99, effective 01/01/2000. Statutory Authority: Chapter 49.17.010, 040, 050, RCW. 98-10-073 (Order 97-11), § 296-24-20505, filed 5/4/98, effective 1/1/99. Order 73-5, § 296-24-20505, filed 5/9/73 and Order 73-4, § 296-24-20505, filed 5/7/73.]

WAC 296-24-20507 What requirements must safeguarding by distance meet? To safeguard by distance, an employer must ensure that:

- The vertical distance between power transmission parts and a floor or walking or working surface is more than seven feet;
- The horizontal distance between power transmission parts and fixed ladders or stairs or other walking or working surface prevents any part of the employee's body from reaching the hazard;
- The power transmission parts are supported so they will not fall on an employee below; and
- No parts or material may fall on an employee below. [Statutory Authority: RCW 49.17.010, .040, .050. 99-19-112 (Order 99-23), § 296-24-20507, filed 09/21/99, effective 01/01/2000. Statutory Authority: Chapter 49.17.010, 040, 050, RCW. 98-10-073 (Order 97-11), § 296-24-20507, filed 5/4/98, effective 1/1/99. Order 73-5, § 296-24-20507, filed 5/9/73 and Order 73-4, § 296-24-20507, filed 5/7/73.]

WAC 296-24-20509 What requirements must safeguarding by location meet? To safeguard by location, an employer must ensure that the location of power transmission parts eliminates the possibility that any part of an employee's body can inadvertently reach the hazard.

An employer may safeguard any location used exclusively for power transmission parts by ensuring that the location:

- Is locked;
- Prohibits unauthorized entrance;
- Has a passageway with an effective vertical clearance of at least five feet six inches;
- Is well lit;
- Has a dry, level, firm floor; and
- Has a safe, well-marked route for an authorized employee to follow. [Statutory Authority: RCW 49.17.010, .040, .050. 99-19-112 (Order 99-23), § 296-24-20509, filed 09/21/99, effective 01/01/2000. Statutory Authority: Chapter 49.17.010, 040, 050, RCW. 98-10-073 (Order 97-11), § 296-24-20509, filed 5/4/98, effective 1/1/99. Order 73-5, § 296-24-20509, filed 5/9/73 and Order 73-4, § 296-24-20509, filed 5/7/73.]

WAC 296-24-20511 What other responsibilities beyond safeguarding does an employer have to protect employees from power transmission parts?

- (1) An employer must remove, make flush, or guard with metal covers all projections on moving parts,

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including keys, setscrews, bolts, and nuts. However, an employer is not required to remove, make flush, or guard keys or setscrews:

- Within an enclosure;
 - Below the rim of a pulley that is less than twenty inches in diameter; or
 - Where employee contact is not possible.
- (a) An employer must fill or cover unused keyways.
- (b) An employer must use only cylindrical revolving collars and ensure that screws or bolts used in collars do not project beyond the outside of the collar.
- (2) An employer must ensure that power transmission parts are inspected at least once every sixty days for compliance with this standard, and are kept in good working condition at all times. An employer's inspection must ensure that:
- A pulley with a cracked or broken piece is not used.
 - All bolts and screws holding power transmission equipment together or supporting the equipment are tight.
 - Belts, lacings, and fasteners are in good repair.
 - Power transmission parts are kept in proper alignment.
- (3) If it is necessary to lubricate power transmission parts while the parts are moving, an employer must ensure that:
- (a) The tool an oiler uses, such as an oil can or grease gun, has a long spout to keep the oiler's hands away from the hazard.
- (b) An oiler must wear closely fitting clothing.
- (c) Drip cups and pans must be securely fastened. [Statutory Authority: RCW 49.17.010, .040, .050. 99-19-112 (Order 99-23), § 296-24-20511, filed 09/21/99, effective 01/01/2000. Statutory Authority: Chapter 49.17.010, 040, 050, RCW. 98-10-073 (Order 97-11), § 296-24-20511, filed 5/4/98, effective 1/1/99. Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-24-20511, filed 7/20/94, effective 9/20/94; Order 73-5, § 296-24-20511, filed 5/9/73 and Order 73-4, § 296-24-20511, filed 5/7/73.]

WAC 296-24-20513 When may a guardrail be used as a safeguard?

- (1) An employer may use a guardrail as a safeguard for:
- A flywheel, when the guardrail is at least fifteen inches from the rim (also see WAC 296-24-20515 for other requirements on flywheels);
 - Cranks and connecting rods;
 - Tail rods and extension piston rods, when the guardrail is at least fifteen inches from the fully extended end of the rod;
 - A horizontal belt in a power generating room;
 - A clutch, cutoff coupling, or clutch pulley in an engine room occupied only by an engine room attendant; or

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- A runway used only for oiling, maintenance, running adjustment, or repair work.
- (2) An employer must ensure that a guardrail used for safeguarding a machine:
 - (a) Has a toeboard at least four inches high; and
 - (b) Complies with WAC 296-24-75011. [Statutory Authority: RCW 49.17.010, .040, .050. 99-19-112 (Order 99-23), § 296-24-20513, filed 09/21/99, effective 01/01/2000. Statutory Authority: Chapter 49.17.010, 040, 050, RCW. 98-10-073 (Order 97-11), § 296-24-20513, filed 5/4/98, effective 1/1/99. Order 73-5, § 296-24-20513, filed 5/9/73 and Order 73-4, § 296-24-20513, filed 5/7/73.]

WAC 296-24-20515 What are the additional requirements for flywheels?

- (1) Flywheels located so that any part is seven feet or less above the floor or platform must be guarded with an enclosure and must be guarded with a guardrail placed not less than fifteen nor more than twenty inches from the rim. When other safeguarding methods cannot be used, an employer must safeguard a spoked flywheel with a smooth rim five feet or less in diameter by using a disk guard.
- (2) The disk must cover the flywheel spokes on the exposed side and create a smooth surface and edge.
 - An open space, a maximum of four inches wide, between the outside edge of the disk and the rim of the wheel may exist to turn the wheel over.
 - A key or other uncovered projection must be cut off.
- (3) An employer may provide an adjustable guard at the flywheel of a gasoline or diesel engine for starting the engine or for a running adjustment. A slot opening for a jack bar is permitted. [Statutory Authority: RCW 49.17.010, .040, .050. 99-19-112 (Order 99-23), § 296-24-20515, filed 09/21/99, effective 01/01/2000. Statutory Authority: Chapter 49.17.010, 040, 050, RCW. 98-10-073 (Order 97-11), § 296-24-20515, filed 5/4/98, effective 1/1/99. Order 73-5, § 296-24-20515, filed 5/9/73 and Order 73-4, § 296-24-20515, filed 5/7/73.]

WAC 296-24-20517 What are the additional requirements for shafting?

- (1) An employer must secure shafting against excessive endwise movement.
- (2) An employer must maintain shafting so that it is free from excess oil or grease and pitting from corrosion.
- (3) An employer may safeguard shafting under a bench machine by using a guard that extends to:
 - (a) Within six inches of the underside of the table or the floor; and
 - (b) At least two inches beyond the shafting.
- (4) An employer must ensure that projecting shaft ends:
 - (a) Have a smooth edge and end and project no more than one-half the diameter of the shaft; or
 - (b) Are guarded by a nonrotating cap or safety sleeve. [Statutory Authority: RCW 49.17.010, .040, .050. 99-19-112 (Order 99-23), § 296-24-20517, filed 09/21/99, effective 01/01/2000. Statutory Authority: Chapter 49.17.010, 040, 050, RCW. 98-10-073 (Order 97-11), § 296-24-20517, filed 5/4/98, effective 1/1/99. Order 73-5, § 296-24-20517, filed 5/9/73 and Order 73-4, § 296-24-20517, filed 5/7/73.]

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WAC 296-24-20519 What are the additional requirements for pulleys?

- (1) An employer must ensure that a pulley is designed and balanced for the speed at which it operates.
- (2) An employer may not use a composition or wood pulley where it is likely to deteriorate in the work-place. [Statutory Authority: Chapter 49.17.010, 040, 050, RCW. 98-10-073 (Order 97-11), § 296-24-20519, filed 5/4/98, effective 1/1/99. Order 73-5, § 296-24-20519, filed 5/9/73 and Order 73-4, § 296-24-20519, filed 5/7/73.]

WAC 296-24-20521 What are the additional requirements for belt and rope drives?

- (1) An employer is not required to safeguard belts operating at two hundred fifty linear feet per minute or less that are:
 - Flat and one inch wide or less; or
 - Flat and between one to two inches wide with no metal lacings or fasteners; or
 - Round and one-half inch or less in diameter; or
 - Single strand v-belts thirteen thirty-seconds inch wide or less.
- (2) An employer may use a nip point and pulley guard on a vertical or inclined belt that:
 - Is two and one-half inches wide or less;
 - Is running at a speed of less than one thousand feet per minute; and
 - Is free from metal lacings or fastenings.

“Nip-point belt and pulley guard” means a device that encloses the pulley and has rounded or rolled edge slots for the belt to pass through.
- (3) When the space between the upper and lower runs of a horizontal belt would allow an employee to pass between them, an employer must:
 - Guard along the upper run; or
 - Provide a platform over the lower run and a railing over the lower run that will prevent employees from leaving the platform.

In a power generating room, only the lower run of a horizontal belt must be guarded.
- (4) The employer must use an idler when using quarter-twist belts that can run in either direction.
- (5) On those belts and rope drives that require dressing, the employer must apply the dressing to a moving belt or rope where the belt or rope leaves the pulley.
- (6) An employer must guard an overhead belt located more than seven feet above the floor or working surface when:
 - The belt is located over a passageway or work space and travels at a speed of one thousand eight hundred feet or more per minute; or
 - The distance between the centers of its pulleys is ten feet or more; or
 - The belt is wider than eight inches.

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- (7) An employer must ensure that a belt shifted by hand is not fastened with metal or other material that creates a hazard. [Statutory Authority: RCW 49.17.010, .040, .050. 99-19-112 (Order 99-23), § 296-24-20521, filed 09/21/99, effective 01/01/2000. Statutory Authority: Chapter 49.17.010, .040, .050, RCW. 98-10-073 (Order 97-11) § 296-24-20521, filed 5/4/98, effective 1/1/99. Order 73-5, § 296-24-20521, filed 5/9/73 and Order 73-4, § 296-24-20521, filed 5/7/73.]

WAC 296-24-20523 What are the additional requirements for gears? An employer is not required to safeguard hand-operated gears used only to adjust machine parts that do not continue to move when not being turned by hand. [Statutory Authority: Chapter 49.17.010, .040, .050, RCW. 98-10-073 (Order 97-11), § 296-24-20523, filed 5/4/98, effective 1/1/99. Order 73-5, § 296-24-20523, filed 5/9/73 and Order 73-4, § 296-24-20523, filed 5/7/73.]

WAC 296-24-20525 What are the additional requirements for belt shifters?

- (1) An employer must ensure that the equipment listed below, if installed after August 17, 1971, has a permanent, mechanical belt shifter:
- Tight and loose (drive and idler) pulleys; and
 - A cone pulley belt.
- (2) An employer must ensure that a belt shifter or clutch handle:
- (a) Safeguards the nip point;
 - (b) Is rounded;
 - (c) Is within easy reach, but minimizes the chance of accidental contact with the operator; and
 - (d) Is located over a machine or bench, or has handles cut off six feet six inches above the floor level.
- (3) No belt shifter is required if:
- The belt is endless or laces with rawhide; and
 - The nip point of the belt and pulley is safeguarded by a nip point guard in front of the cone; and
 - The guard extends at least to the top of the largest step of the cone and is formed to show the contour of the cone.
- (4) An employer must ensure that each belt shifter and clutch handle of the same type in a workplace moves in the same direction to stop a machine, i.e., either all right or all left.
- (a) A friction clutch handle on a countershaft carrying two clutch pulleys with open and crossed belts is not required to move in the same direction; and
 - (b) The clutch handle must have three positions with the machine at rest when the clutch handle is in the center position.
- (5) An employer must ensure that a belt tightener used to activate machinery:
- (a) Is substantially constructed and securely fastened;
 - (b) Has bearings securely capped;

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- (c) Has a mechanism to prevent it from falling; and
 - (d) Is securely held in the “off” position by gravity, or by an automatic mechanism that must be released by hand.
- (6) An employer may not use a belt pole to shift a belt on and off a fixed pulley. When a belt shifter cannot be used, an employer may use a belt pole that is:
- (a) Smooth; and
 - (b) Large enough for an employee to grasp securely.
- Note: A belt pole is also known as a “belt shipper” or “shipper pole.”*
- (7) An employer must use a substantial belt perch, such as a bracket, roller, etc., to safely shift an idle belt away from a shaft when a loose pulley or idler is not practical.
- (8) An employer must ensure that a bearing support immediately adjacent to a friction clutch or cutoff coupling has self-lubricating bearings requiring infrequent attention. [Statutory Authority: RCW 49.17.010, .040, .050. 99-19-112 (Order 99-23), § 296-24-20525, filed 09/21/99, effective 01/01/2000. Statutory Authority: Chapter 49.17.010, 040, 050, RCW. 98-10-073 (Order 97-11), § 296-24-20525, filed 5/4/98, effective 1/1/99. Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-24-20525, filed 7/20/94, effective 9/20/94; Order 76-6, § 296-24-20525, filed 3/1/76; Order 73-5, § 296-24-20525, filed 5/9/73 and Order 73-4, § 296-24-20525, filed 5/7/73.]

WAC 296-24-20527 What are the additional requirements for sewing machines? No guard is required for belt drives on a light or medium duty sewing machine if:

- It uses either a flat or a round belt without metal lacings and fasteners;
- The belt is located above the table top;
- The machine is not used to sew heavy materials such as leather, canvas, denim, or vinyl;
- The operators’ hands are not in, near, or on the wheel, nip point, or belt area when the machine is operating;
- The distance between the area where the operator is holding and feeding material with both hands and the belt or wheel location is great enough that the operator is not exposed to a motion hazard; and
- The table top is designed so that employees near the machine are not exposed to motion hazards while they work or as they pass by. [Statutory Authority: RCW 49.17.010, .040, .050. 99-19-112 (Order 99-23)§ 296-24-20527, filed 09/21/99, effective 01/01/2000. [Statutory Authority: Chapter 49.17.010, 040, 050, RCW. 98-10-073 (Order 97-11), § 296-24-20527, filed 5/4/98, effective 1/1/99. Order 73-5, § 296-24-20527, filed 5/9/73.]

WAC 296-24-20529 Reserve. [Statutory Authority: Chapter 49.17.010, 040, 050, RCW. 98-10-073 (Order 97-11), § 296-24-20529, filed 5/4/98, effective 1/1/99. Order 73-5, § 296-24-20529, filed 5/9/73 and Order 73-4, § 296-24-20529, filed 5/7/73.]

WAC 296-24-20531 Reserve. [Statutory Authority: Chapter 49.17.010, 040, 050, RCW. 98-10-073 (Order 97-11), § 296-24-20531, filed 5/4/98, effective 1/1/99. Order 76-6, § 296-24-20531, filed 3/1/76; Order 73-5, § 296-24-20531, filed 5/9/73 and Order 73-4, § 296-24-20531, filed 5/7/73.]

WAC 296-24-20533 Reserve. [Statutory Authority: Chapter 49.17.010, 040, 050, RCW. 98-10-073 (Order 97-11), § 296-24-20533, filed 5/4/98, effective 1/1/99. RCW 49.17.040, 49.17.050, 49.17.240, chapters 43.22 and 42.30 RCW. 80-17-015 (Order 80-21), § 296-24-20533, filed 11/13/80; Order 73-5, § 296-24-20533, filed 5/9/73 and Order 73-4, § 296-24-20533, filed 5/7/73.]

Appendix B - General Guarding Checklist

Answers to the following questions should help you determine the safeguarding needs of your own workplace, by drawing attention to hazardous conditions or practices requiring correction.

Machinery

		Y	N
1.	Do the safeguards provided meet the minimum WISHA requirements?	<input type="checkbox"/>	<input type="checkbox"/>
2.	Do the safeguards prevent workers' hands, arms, and other body parts from making contact with dangerous moving parts?	<input type="checkbox"/>	<input type="checkbox"/>
3.	Are the safeguards firmly secured and not easily removable?	<input type="checkbox"/>	<input type="checkbox"/>
4.	Do the safeguards ensure that no objects will fall into the moving parts?	<input type="checkbox"/>	<input type="checkbox"/>
5.	Do the safeguards permit safe, comfortable, and relatively easy operation of the machine?	<input type="checkbox"/>	<input type="checkbox"/>
6.	Can the machine be lubricated without removing the safeguard?	<input type="checkbox"/>	<input type="checkbox"/>
7.	Is there a lockout/tagout system for shutting down the machinery before safeguards are removed?	<input type="checkbox"/>	<input type="checkbox"/>
8.	Can the existing safeguards be improved?	<input type="checkbox"/>	<input type="checkbox"/>
9.	Is there a safeguard provided for the power transmission part(s)?	<input type="checkbox"/>	<input type="checkbox"/>
10.	Does it keep the operator's hands, fingers, body out of the danger area?	<input type="checkbox"/>	<input type="checkbox"/>
11.	Is there evidence that the safeguards have been tampered with or removed?	<input type="checkbox"/>	<input type="checkbox"/>
12.	Could you suggest a more practical, effective safeguard?	<input type="checkbox"/>	<input type="checkbox"/>
13.	Are there any unguarded gears, sprockets, pulleys, or flywheels on the apparatus?	<input type="checkbox"/>	<input type="checkbox"/>
14.	Are there any exposed belts or chain drives?	<input type="checkbox"/>	<input type="checkbox"/>
15.	Are there any exposed set screws, key ways, collars etc.?	<input type="checkbox"/>	<input type="checkbox"/>
16.	Are starting and stopping controls within easy reach of the operator?	<input type="checkbox"/>	<input type="checkbox"/>
17.	If there is more than one operator, are separate controls provided?	<input type="checkbox"/>	<input type="checkbox"/>
18.	If there is more than one operator, can one start the machine and injure the other operator?	<input type="checkbox"/>	<input type="checkbox"/>

Training

18.	Do operators and maintenance workers have the necessary training in how to use the safeguards and why?	<input type="checkbox"/>	<input type="checkbox"/>
19.	Have operators and maintenance workers been trained in where the safeguards are located, how they provide protection, and what hazards they protect against?	<input type="checkbox"/>	<input type="checkbox"/>
20.	Have operators and maintenance workers been trained in how and under what circumstances guards can be removed?	<input type="checkbox"/>	<input type="checkbox"/>
21.	Have workers been trained in the procedures to follow if they notice guards that are damaged, missing, or inadequate?	<input type="checkbox"/>	<input type="checkbox"/>

Appendix B - General Guarding Checklist

Other Concerns

Protective Equipment and Proper Clothing

Y N

- | | | | |
|-----|--|--------------------------|--------------------------|
| 22. | Is personal protective equipment required? | <input type="checkbox"/> | <input type="checkbox"/> |
| 23. | If personal protective equipment is required, is it appropriate for the job, in good condition, kept clean and sanitary, and stored carefully when not in use? | <input type="checkbox"/> | <input type="checkbox"/> |
| 24. | Is the operator dressed safely for the job (i.e., no loose-fitting clothing or jewelry)? | <input type="checkbox"/> | <input type="checkbox"/> |

Machinery Maintenance and Repair

- | | | | |
|-----|--|--------------------------|--------------------------|
| 25. | Have maintenance workers received up-to-date instruction on the machines they service? | <input type="checkbox"/> | <input type="checkbox"/> |
| 26. | Do maintenance workers lock out the machine from its power sources before beginning repairs or clearing jams? | <input type="checkbox"/> | <input type="checkbox"/> |
| 27. | Where several maintenance persons work on the same machine, are multiple lockout devices used? | <input type="checkbox"/> | <input type="checkbox"/> |
| 28. | Do maintenance persons use appropriate and safe equipment in their repair work? | <input type="checkbox"/> | <input type="checkbox"/> |
| 29. | Is the maintenance equipment itself properly guarded? | <input type="checkbox"/> | <input type="checkbox"/> |
| 30. | Are maintenance and servicing workers trained in the requirements of 24-110, lockout/tagout hazard, and do the procedures lockout/tagout exist before they attempt their tasks? | <input type="checkbox"/> | <input type="checkbox"/> |